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Indian Standard

GAS DETECTOR TUBES – GENERAL REQUIREMENTS AND METHODS OF TEST

UDC 614.824.4

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1992 **Price Group 2**

Industrial Safety Sectional Committee, CHD 008

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Stardards, after the draft finalized by the Industrial Safety Sectional Committee had been approved by the Chemical Division Council

A detector tube is a glass tube containing a chemical reagent in which a colour change may be produced when a sample of the atmosphere is drawn through it The length of the stain produced, or a comparison of the colour change with a set of standard colours, provides a measure of the level of contamination by a specified gas or vapour However, this standard does not specify the requirements for detection of specific gases, for which relevant standards may be referred to.

Gas detector tubes provide means for obtaining a rapid, but approximate, measurement of concentrations of the toxic gases or vapours in suspect atmospheres This standard has been prepared to assist those responsible for assessing the hazards posed by the presence of such substarces in work place by establishing standard performance requirements for detector tubes.

A guide to the acceptability, or unacceptability, of the measured concentrations is provided by the list of threshold limit values.

It is recommended that length-of-stain tubes shall be used whenever possible as they provide for greater accuracy and more objective measurement than colour-match tubes

In the preparation of this standard, assistance has been drawn from BS 5343 : 1976 'Specification for gas detector tubes'

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised)* '.

AMENDMENT NO. 1 JANUARY 2000
TO
IS 13293 : 1992 GAS DETECTOR TUBES — GENERAL REQUIREMENTS AND METHODS OT TEST

(*Page* 1,*clause* **2.1.3,** *line* 3*)* — Substitute '100 cc/min' *for* '1 cc/sec'.

(Page 1, *clause* **2.2.3**, *line* 1) — Substitute '10 mm' *for* '15 mm'.

(CHD 08)

Reprography Unit, BIS, New Delhi, India

Indian Standard

GAS DETECTOR TUBES – GENERAL REQUIREMENTS AND METHODS OF TEST

1 SCOPE

The standard specifies requirements for gas detector tubes and their associated aspirating pumps, used at normal atmospheric pressure and temperature for evaluating atmospheric hazards (not including oxygen deficiency) at concentrations in the region of the threshold limit values It covers length of stain tubes and colour match tubes. Appearance of colour tubes are excluded because of their limitations.

2 REQUIREMENTS

2.1 Aspirating Pump

2.1.1 The aspirating pump used with a given detector tube shall be that specified by the manufacturer of the tube As supplied, the pump shall aspirate a volume of air within ±5 percent of the volume stated by the manufacturer.

2.1.2 Pumps shall be checked for leakage in accordance with the manufacturer's instructions before each occasion of use and, for accuracy, volume and rate of suction at least every three months A suitable method of pump calibration which may also be used for subsequent performance testing is given in Annex A Pumps shall be maintained in accordance with the manufacturer's instructions and shall not be used if their accuracy falls outside ± 10 percent.

2.1.3 The rate of suction of the pump for aspirating through the detector tube shall be 1 cc/sec.

2.2 Length of Stain Tubes

2.2.1 *Accuracy*

Tubes shall be calibrated against atmosphere whose concentrations of appropriate gas or vapour in air have been standardized to within ±5 percent of the desired concentrations (standard atmosphere).

2.2.1.1 Length of stain tubes shall be accurate with a 95 percent confidence limit between the following ranges when aspirated in accordance with the manufacturer's instructions and at all temperatures between 5°C and 40°C:

+30 percent and — 20 percent at the Threshold Limit Value (TLV)

+50 percent and — 20 percent at concentrations of twice and half of TLV

NOTE — A precautionary slip mentioning that the tube will not be accurate at a temperature above 40°C shall be attached to the tubes

2.2.2 *Graduation*

Tubes shall be graduited in volum; or mass per unit volume of air or, alternatively, be accompanied by a calibration graph in the same units The graduation of the tubes shall permit the measurement of concentrations of half the TLV and twice the TLV.

2.2.3 *Length and End Point of Stain*

The length of stain shall be not less than 15 mm after aspiration of the recommended volume of the gas mixture at the concentration of the TLV of the gas being detected. The maximum variation of stain length around the circumference of the tube at the interface between the stained and unstained indicator layer shall not exceed 20 percent of the stain length when measured at its point of maximum length at concentrations of half the TLV and above of the gas being detected.

2.2.4 The boundary between the indicitor layer and any inert packing or cleansing layers shall be such that the difference between the longest and shortest length of packing or cleansing layers around the circumference of the tube does not exceed 1 mm.

2.3 Colour-Match Tubes

2.3.1 *Accuracy*

Colour-match tubes are generally less accurate than length-of-statn tubes because of the subjective nature of colour comparison, but some control of accuracy is obtained by controlling the number of aspirations required to produce a colour match Tubes shall be calibrated against standard atmospheres (*see* **2.2.1**). A minimum of five aspirations shall be necessary to produce a colour indicating the TLV when aspirated in accordance with manufacturer's instructions at a concentration of the TLV There shall be a distinct difference in the colour at one aspiration more and one less than the number of aspirations required to indicate the TLV The tubes shall meet these requirements at all temperatures between 5°C and 40° C.

2.3.2 Tubes shall be accompanied by a colour chart, a table or a mathematical formula for evaluating the concentration in units of volume or mass per unit volume of air.

2.3.3 Tubes shall permit the measurement of concentrations of half the TLV and twice the TLV.

2 4 Life of Tubes

Tubes shall comply with the requirements of this standard for a period of at least two years from the date of batch testing provided that the temperature at which they are stored does not exceed 35°C.

3 GENERAL INSTRUCTIONS

Manufacturer's instructions shall be supplied with each aspirating pump and with each box of detector tubes and shall include the following

3.1 Aspirating Pupms

3.1.1 A warning that, because pumps made by different manufacturers may not operate at the same rate even when they draw the same volume, they should not be interchanged.

3.1.2 Testing instructions for leakage before each occasion of use.

3.1.3 Maintenance instructions.

3.2 Detector Tubes

3.2.1 Directions that, aspirating pumps shall be tested for leakage before each occasion of use

3.2.2 Information on the general reactions involved in the system and the levels at which other gases and vapours, including water vapour, are likely to interfere to the extent of reducing the accuracy below the level prescribed in this standard.

3.2.3 Where appropriate, a warning that, the contents of tubes are hazardous, together with disposal instructions.

3.2.4 Where appropriate, any special requirements for lighting needed to emure the reliable reading of colour-match and length-of-stain tubes.

3.2.5 For colour-match tubes, instructions for evaluating the colour change.

3.2.6 The time required for the completion of one aspiration and permitted limits on this time.

3.2.7 The limitations on re-use when tubes are designed to be used more than once.

4 MARKING

4.1 Boxes

Each box of detector tubes shall be marked with the following items.

a) The names of the gases or vapours for which the tubes may be used and the concentration ranges,

b) The manufacturer's batch number,

c) The expiry date, and

d) Recommended storage temperatures.

4.2 Tubes

Each tube shall be marked with the direction of gas flow.

ANNEX A

(*Clause* 2.1.2)

METHOD OF TESTING ASPIRATING PUMPS

A-1 APPARATUS

A-1.1 Calibrated tube *A* 400 mm long and 30 mm in diameter, fitted with an inlet tube *B* rising to a height of 250 mm within *A,* a draincock *C* and a connection point *D*, for the aspirator pump and detector tube as shown in Fig. 1.

A-1.2 Water reservoir of approximately 2 litres capacity, fitted with a pressure regulating tube *E* and a stopcock *G,* as shown in Fig. 1. Connect the reserevoir to the bottom of tube *B* with flexible tubing.

A-2 PROCEDURE

Adjust the height of the reservoir so that the bottom of tube *E* is in the same level with the top of tube *B*. With *D* open to air, open the reservoir stopcock *G* and make any further adjustments necessary to ensure that tube *B* is filled with water just short of overflowing. Open cock *C* to drain tube *A* and then close cock *C*. Attach the aspirator pump to a freshly opened detector tube, and the tube to point *D* and operate the pump in accordance with the manufacturer's instructions. Read the volume of water drawn into tube *A* from graduations on the tube or by draining the water into a graduated cylinder.

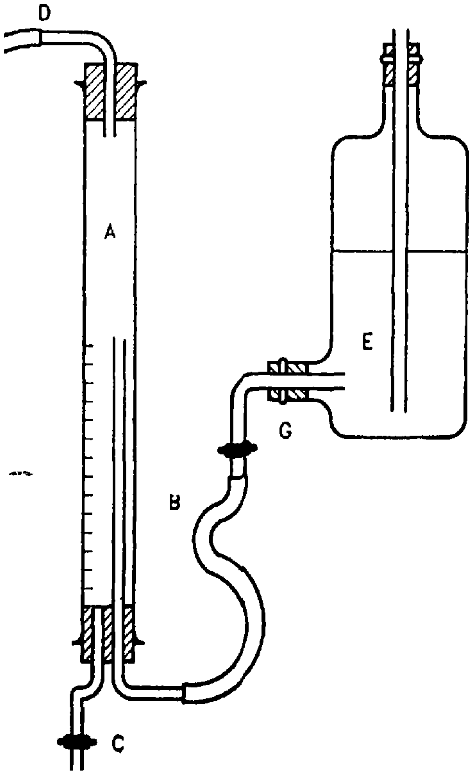

FIG. 1 APPARATUS FOR CALIBRATING ASPIRATING PUMPS

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